Issued December 30, 1915.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE STATE OF INDIANA DEPARTMENT OF GEOLOGY,
EDWARD BARRETT, STATE GEOLOGIST.

SOIL SURVEY OF CLINTON COUNTY, INDIANA.

BY

W. E. THARP, OF THE U. S. DEPARTMENT OF AGRICULTURE,
AND R. H. PEACOCK AND C. M. ROSE, OF THE
INDIANA DEPARTMENT OF GEOLOGY.

W. E. McLENDON, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1914.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1915.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., June 23, 1915.

SIR: Under the cooperative agreement with the State of Indiana Department of Geology, Edward Barrett, State geologist, a soil survey of Clinton County was carried to completion during the field season of 1914.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1914, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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MAP.

Soil map, Clinton County sheet, Indiana.

SOIL SURVEY OF CLINTON COUNTY, INDIANA.

By W. E. THARP, of the U. S. Department of Agriculture, and R. H. PEACOCK and C. M. ROSE, of the Indiana Department of Geology.

DESCRIPTION OF THE AREA.

Clinton County is located in the north-central part of Indiana. It is bounded on the north by Carroll County, on the northeast by Howard County, on the east by Tipton and Hamilton Counties, on the south by Boone County, and on the west by Tippecanoe and Montgomery Counties. The county has an area of 398 square miles, or 254,720 acres.

The surface varies from gently undulating to moderately rolling, with a general elevation of about 900 feet above sea level. A rolling topography prevails for a distance of one-fourth to 1 mile on each side of the larger streams. Along the lower and middle courses of these creeks blufflike slopes 20 to 50 feet high inclose the narrow valleys, which in most places are less than one-half mile wide. These low escarpments are a measure of the erosion that has taken place since the disappearance of the ice sheet. Elsewhere the surface configuration has been but little modified by running water.

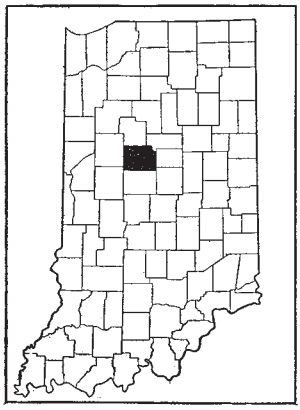

FIG. 1.—Sketch map showing location of the Clinton County area, Indiana.

The northern half of the county has stronger relief than the southern part. A considerable proportion of the latter, extending from the neighborhood of Cylcone westward to Manson and Jefferson, lies in an extensive, slightly depressed area, locally known as Twelve-Mile Prairie. Frankfort is situated on the northern margin, while the southern limits are 2 or 3 miles north of the Boone-Clinton boundary line. The surface, especially in the west half, is characterized by many nearly flat areas a few rods to one-half mile wide, while the relief over the remainder is not more than sufficient to give good drainage to the highest ground.

The southeastern townships have a slightly greater elevation than the Twelve-Mile Prairie, but the topography is so mild that a view conveys the impression of a slightly uneven plain. The Sugar Creek

drainage north and west of Kirklin is intrenched in narrow valleys 10 to 30 feet below the immediately adjacent uplands. The latter for a mile or so on each side of the main stream are strongly undulating, with occasional shallow ravines, but there is very little ground so rough as to prevent the use of farm machinery.

Similar surface configuration generally prevails throughout the east-central and eastern sections of the county; also on the main interstream divides separating Wild Cat, Kilmore, Campbell, and Middlefork Creeks from one another. Although the land near these streams is moderately rolling, some distance back the surface for the most part consists of low, broad swells and local divides of slight but unequal elevation and very indefinite direction of trend. The intervening depressions are similarly irregular in extent, but their margins, in recently plowed fields, are sharply indicated by the black color of the soil, which contrasts strongly with the gray silt loam of the higher ground.

From Jefferson northwest to the Clinton-Tippecanoe line, and thence to Mulberry, the surface is generally somewhat rolling, with small areas of hilly land near Wild Cat Creek. Rather strong relief prevails between Mulberry and Rossville, although there are occasional areas a few square miles in extent that are nearly level. Between Sedalia and Geetingsville there are a number of prominent morainic ridges, one-fourth to one-half mile long and rising from 25 to possibly 50 feet above the general level of the land in their vicinity. Smaller but less prominent mounds are not uncommon throughout the northern part of the county.

All the streams flow toward the west, except the southernmost, Potato and Sugar Creeks, which flow southwest. The larger streams maintain their flow in all seasons, but the small tributaries and most of the dredged ditches were dry during the summer of 1914.

On the uplands excellent water may be obtained at depths varying from 25 to 50 feet, while on the low areas an unfailing supply is usually found at 10 to 15 feet. The source of the latter is the gravel beds that so generally underlie the larger bodies of the black soils. In recent years many farmers on the uplands have driven wells 100 to 150 feet deep, which in nearly all instances insure an unlimited supply of water for live stock.

Most of this county was originally very heavily forested. On the well-drained lands sugar maple, walnut, poplar, hickory, beech, and several kinds of oak were the predominant varieties, while elm, ash, and white oak were more commonly found in the poorly drained locations. The "prairies" were not wide areas of open land, but had many islandlike groves of white and post oak on the slightly elevated knolls, and there were numerous patches of small timber, with much hazel brush, on all the higher ground. The wide flats and all the

depressed areas were either marshes or ponds during the greater part of each season. The present remnants of the forest are mostly open woodland pastures with but little undergrowth, occasional "sugar camps," and many beautiful groves around farm buildings.

Nearly all of the public roads of the county are well graded and surfaced with crushed stone or gravel. Four railroads and two interurban lines radiate from Frankfort. The rural population is 18,040, the urban 10,586.[1] Most of the farm houses are well built and have good outbuildings and barns, while in all sections silos are becoming a feature of farm improvements. Practically every farm home has telephone service and rural delivery of mails.

CLIMATE.

The following table, compiled from the records of the Weather Bureau station at Lafayette, Tippecanoe County, 25 miles northwest of Frankfort, giving the normal monthly, seasonal, and annual temperature and precipitation and the occurrence of killing frosts in the spring and fall, represents fairly accurately the conditions in Clinton County.

Normal monthly, seasonal, and annual temperature and precipitation at Lafayette.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	29.7	69	−17	2.59	1.95	5.84	3.5
January	25.3	70	−33	2.47	1.18	.40	7.0
February	26.9	69	−26	2.75	2.94	5.78	6.3
Winter	27.3			7.81	6.07	12.02	16.8
March	37.6	83	− 5	3.20	1.41	3.30	4.4
April	50.5	89	10	3.27	2.94	2.25	.4
May	61.5	97	25	4.40	2.11	3.82	Trace.
Spring	49.9			10.87	6.46	9.37	4.8
June	70.7	100	33	4.43	1.97	7.16	.0
July	74.6	105	42	3.77	.88	2.05	.0
August	72.6	102	39	3.23	3.08	.47	.0
Summer	72.6			11.43	5.93	9.68	.0
September	66.1	101	29	2.77	3.02	4.20	.0
October	53.3	92	16	2.35	1.62	4.42	Trace.
November	39.5	95	− 1	3.06	3.72	6.49	1.2
Fall	53.0			8.18	8.36	15.11	1.2
Year	50.7	105	−33	38.29	26.82	46.18	22.8

Average date of first killing frost in fall, Oct. 5; last in spring, Apr. 26. Date of earliest recorded killing frost in fall, Sept. 14; of latest in spring, May 27.

[1] Census by post office, 1914.

The snowfall is quite variable from year to year. As a rule the snow drifts heavily, on account of the generally clean condition of the fields, and often occasions injury to fall-sowed grains.

AGRICULTURE.

The first settlement in Clinton County was made in 1826 on the western margin of Twelve-Mile Prairie. Since at that time and for several decades afterwards only ground having good natural drainage could be cultivated, all of the earlier homesteads were located on the more rolling land. As a rule the first fields were small, and the extension of the cleared area was necessarily slow. While some land has been in cultivation 75 or 80 years, the average period of tillage of the lighter colored soils is much less, probably about 50 years. The smaller and more easily drained areas of black soils were gradually brought into tillage during all this time, but the largest tracts have, as a rule, been reclaimed within the last 25 or 30 years.

Corn, oats, and wheat are the chief crops, and now rank in acreage in the order named. The following table, compiled from census returns, gives the acreage and production of these three crops in the last four census years:

Acreage and production of principal crops.

Year.	Corn.		Wheat.		Oats.	
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
1909	88,004	4,718,472	24,579	462,004	44,042	1,676,952
1899	78,353	4,242,120	49,265	483,470	7,515	320,500
1889	62,387	1,959,961	46,080	657,157	11,231	378,236
1879	55,813	2,042,485	37,956	863,631	6,345	196,908

The steady increase in the acreage devoted to corn is due in part to the reclamation of the black land, and also in large measure to the fact that corn is the most profitable of all cereal crops. Broadly speaking, the production of this crop is limited only by the acreage of land in condition to meet its requirements. Three or more successive plantings of corn are almost out of the question on the light-colored soils, and it is also necessary to change frequently to small grain and clover on most of the older black lands. A rotation including clover is now recognized as a necessity on practically all types of soil except some of the more recently drained Clyde soils and some bottom-land types. There are many farmers who would eliminate wheat and oats from the rotation were it practicable to secure a stand of clover without seeding land to one or the other of these grains.

Neither is very profitable in itself, and in unfavorable seasons the value of the grain usually is less than the total cost of its production.

Owing to the practice of seed selection, thorough preparation of the ground, and the use of fertilizer on the light-colored soils, wheat is more generally profitable now than it was some years ago. In the season of 1914 land that had been fertilized, or to which much manure had been applied in previous years, produced 5 to 15 bushels per acre more than similar land that had not been so treated. On the latter 15 to 20 bushels per acre was the range in yield.[1]

Oats are not given as much attention as either wheat or corn. The crop is never fertilized, and in many instances land out of condition for corn and not desirable for wheat is utilized for the oat crop. Very often the seeding is done when the soil is in poor condition for tillage, especially on the flat portions of the Miami silt loam. In the wet season of 1912 most of the oat crop on the Clyde soils was so heavy as to lodge badly and much of the grain was lost, but on the Miami types the yield was generally good. In the dry season of 1914, however, the crop on the latter types was almost a failure, while average yields of 40 to 50 bushels per acre were obtained on the Clyde and Carrington soils. Similar results in previous years show the greater sensitiveness of oats to seasonal conditions than is the case with wheat or corn.[2] Rye gives good results, but is not extensively grown. This crop requires less moisture than oats, and is a good nurse crop for clover. If not harvested it affords sufficient pasturage to pay for the seed and labor of sowing.

Timothy, which is quite commonly grown in combination with clover, is not a desirable crop from the standpoint of soil improvement. Buegrass is an abundant pasture growth in the county. Many of the soils, especially the Miami types, would be better suited to this grass with liming.

Sweet clover is common in some localities, but not generally abundant. Where this plant flourishes conditions are generally favorable for alfalfa, especially with respect to bacteria in the soil. Many small patches of alfalfa have been successfully established and the number of fields is steadily increasing. This legume does well on the Clyde silty clay loam and in places on the creek-bottom soils. On the Miami soils the moisture supply is not so good as on those just mentioned, and the deficiency in lime must be corrected. The brownish-gray soil, where the depth to brown, gravelly clay does not exceed 25 inches, is preferable to the lighter colored land. Spring seeding with a nurse crop usually fails if dry weather follows the removal of the small grain. The best results are generally obtained

[1] Circulars Nos. 10 and 23, Agr. Expt. Sta., Purdue University.

[2] Oats require about 500 pounds of water for each pound of dry matter—straw and grain—that is matured. Corn uses about 300 pounds of water per pound of dry matter.

by breaking ground in the spring, disking frequently to kill weeds and obtain a good condition of tilth, and sowing in July or August.

Tomatoes are the only truck crop of importance. There is a canning factory at Frankfort and shipping stations at several of the smaller towns. The contract price is now $10 a ton, and the yields in recent years have ranged from 2 to 10 tons per acre. The Clyde soils are preferred on account of the earlier and stronger growth of the plants, but in favorable seasons the crop does as well on the Miami soils, and the quality is somewhat better.

The total acreage of small fruits in the county, according to the census of 1910, is 23 acres. The local demand is largely supplied from outside sources. Farm orchards are not generally given much attention. In the season of 1914 the yields of apples throughout the county were very small, except in one or two instances where special care had been given the trees.

A considerable number of cattle are fed in Clinton County, chiefly by farmers holding more than 200 or 300 acres of land. The smaller landowners do not, as a rule, have many cattle other than milch cows. Although much milk and cream is sold in Frankfort or shipped to Indianapolis, dairying has not been so extensively developed as in some of the adjoining counties. On almost every farm the sale of fattened hogs affords the largest item of income. A few sheep are raised, and western lambs are occasionally purchased for feeding.

The cultural methods employed on most farms are quite as thorough and efficient as practiced anywhere in the corn belt. The latest and best types of farm implements are in general use. The disk harrow and roller, as well as other devices for making a dust mulch in cornfields at the close of regular cultivation, are now used on nearly every farm.

The rotation most commonly practiced on the Miami soils is wheat or oats, followed by clover, allowing the latter to stand two seasons, then corn. On the Clyde and Carrington soils corn is often planted two years, or even longer, in succession, and a regular change to clover is not so necessary as on the Miami types. In several instances a three-year rotation, consisting of wheat, English clover, and corn, is most successfully practiced on the Miami soils. The clover is clipped for seed, but the bulk of the crop is plowed under, or used for pasture. One hundred to 200 pounds of commercial fertilizer is applied to the land at the time of seeding to wheat. On one or two farms where this system has been followed a decided increase in the average yield of both wheat and corn has resulted.

During the last few years there has been a rapid increase in the use of commercial fertilizer. The brands most generally used contain 0.5 to 1 per cent of nitrogen, 2 to 5 per cent of potash, and 8 to 10

per cent of phosphoric acid and the usual rate of application is 100 to 200 pounds per acre. As previously stated, fertilizer is most frequently used on wheat land. A few farmers are applying commercial fertilizer to corn land, using a grade somewhat higher in nitrogen than the above-mentioned formulas. In some instances the proportion of potash is increased on lands inclined to be "chaffy." The increased yields and improvement in the quality of wheat where commercial fertilizers are used leave no doubt as to the profitableness of this practice.

According to the census, there were 2,724 farms in the county in 1910, with an average size of 93.2 acres, while in 1890 there were 2,885 farms, with an average size of 87 acres. The number of small holdings near the larger towns and along the electric railways has undoubtedly increased in recent years, but a steady increase in the size of the moderately large farms is observable in the county as a whole. While there are many farms of 40 acres and less, the majority range from 160 to about 240 acres. There are very few holdings exceeding 500 acres. Under present conditions the large farms can be operated more economically than small ones.

The average value of farms, according to the last census, is $13,472, of which 78.3 per cent is accredited to the land, 11.1 per cent to buildings, 8.5 per cent to domestic animals, and 2.1 per cent to implements. This division of the total valuation leaves $113.20 an acre for the land itself, which is a conservative estimate, considering the prices that farm lands command at present. Very little unimproved land is held at less than $125 an acre, while well-improved and desirably located farms are held at prices ranging from $150 to more than $200 an acre.

Forty per cent of the farms are now operated by tenants. Thirty years ago the proportion was less than 30 per cent. The present terms, in most instances, are two-fifths of the grain and cash rental for meadow and pasture land, with additional payment for the use of house and buildings. Most leases are for one year, but some tenants have arrangements for a longer period, and in a few instances a rotation of crops is planned and considerable attention given to live stock.

SOILS.

The surface formation of the county is a drift sheet usually referred to as belonging to the early Wisconsin period of glaciation. In the uplands the total depth of this bowlder clay, with included beds of gravel, is 100 to 150 feet. The lower part of this heavy mantle of unconsolidated material doubtless represents older till, but neither this nor the underlying rock has influenced the soils to any appreciable extent.

The glacial material as exposed in road cuts and other shallow excavations is a very light brown or pale yellowish brown mixture of silt, clay, and sand, with a somewhat variable proportion of gravel and small stones. The latter consist largely of resistant rocks such as diorite, quartz and quartzites, and fine-grained granites. There are usually no shale and very few sandstone fragments present. At a depth of a few feet pieces of limestone are numerous, and the till from this depth downward is very calcareous.

The greater proportion of the till consists of silt, clay, and the finer grades of sand. It is quite compact but not impervious. The surface of artificial exposures usually assumes a loose, crumbly condition, and a rather fine granular structure is more or less apparent throughout the mass as deep as weathering has affected it, which may be very roughly estimated as 5 to 15 feet. Below this depth, except where gravel occurs, the till is more compact, of a dull bluish gray color, and very calcareous. In many places, particularly in the large structural depressions, as well as in the valleys formed by postglacial erosion, gravel beds are found at a depth of a few feet.

The friable structure admits of comparatively rapid absorption of water and the free movement of the soil moisture by capillarity. Effective aeration to a depth of 2 or 3 yards is indicated by the rather high degree of oxidation of the iron content or by the prevalence of pronounced yellow and brown tints to that depth.

The till as described above, however, does not form the surface soils, except in areas of very small extent. It is almost everywhere covered to a depth of 3 or 4 feet by a silty deposit in which there is comparatively little stony material. This resembles loess, having about the same mechanical composition and general physical properties as shallow deposits of that material which overlie glacial formations in many other sections of the Mississippi Basin. Fifty to 70 per cent of this silty surface layer consists of that grade of soil particles known as silt, which are intermediate in size between very fine sand and clay. The first few inches of this material usually contains fine sand, enough to be easily felt when the otherwise smooth, fine-textured soil is rubbed between the fingers. The lower part contains less sand, and a correspondingly higher proportion of clay, and consequently is more compact. At a depth of 20 to 30 inches on the moderately undulating uplands, and at a somewhat less depth on the more rolling lands, the silty material grades into bowlder clay. The contact in most instances is fairly well defined and seldom varies greatly from the above-mentioned depths. The chief exceptions in this respect occur on steep slopes where the silty covering has been partially removed by erosion.

To the almost universal occurrence of this loesslike surface stratum is due the wide extent of silty, stone-free soils of this and adjoining counties.

This deposit attains its maximum average thickness on the flat to very gently undulating portions of the uplands. Where such topography prevails the surface soil is very light colored and the subsoil is more or less mottled, light-grayish and pale-yellow tints predominating. This coloration, with a noticeable lack of granular structure in the upper part of the soil section, is generally evident wherever the depth to the bowlder clay exceeds 30 to 40 inches. Such a development of the upland soils has been mapped as a flat phase of the Miami silt loam. It is in this phase that the so-called "clay spots" most frequently occur.

On the undulating to moderately rolling uplands the silty stratum is thinner, and as a rule contains a slightly higher percentage of sand than where the relief is less pronounced. It is more permeable to air and water, and brown and yellowish-brown shades prevail throughout most of the soil section, indicative of a good physical structure. These well-drained and easily tilled lands constitute the typical Miami silt loam. This type corresponds in a general way with the "sugar-tree lands" and "walnut lands" of the early settlers, names still retained to some extent in local usage.

Both the Miami silt loam and its flat phase are deficient in humus. This is due to the fact that prior to the settlement of the county all these uplands were heavily forested. With such a forest cover well-drained upland soils in temperate climates accumulate little organic matter. Even the organic matter which may have been gained when the land was prairie (as was undoubtedly the case here) may be largely lost after it becomes forested. Evidence of this fact is furnished by the Carrington silt loam of this and adjoining counties. The mineralogical character of this latter type and its general surface configuration are almost identical with those of the Miami silt loam, but the soil is black on account of the high content of humus. The Carrington was treeless, or nearly so, when the first settlers entered the country and retains much of the organic matter that was accumulated during the long period when the surface was covered with grasses and herbaceous vegetation.

In the depressions without natural outlets swampy or semimarshy conditions prevailed until the present artificial drainage channels were made. Some of these basins were shallow lakes or prairie marshes, but by far the larger proportion of them were forested, the character of the timber being determined largely by average drainage conditions. Elm, hickory, and ash occupied the lands that were free from water a considerable portion of the time, while scattering willow, cottonwood, sycamore, and other moisture-enduring species

marked the encroachment of the forest along the sluggish streams and margins of the lakes and Muck beds. While a black humus-laden soil will develop in the poorly drained forest lands, it seems highly probable that the greater part of the black carbonaceous material that gives the black lands their distinctive color was accumulated during the prairie stage of their existence.

In general the development of the principal types has been determined (1) by topographic position, (2) by thickness of the superficial silty stratum, and (3) by the character of the original vegetation. The first directly affects the drainage conditions as a whole, the second exerts much influence upon the average moisture content of the soil mass, while the last has determined the kind and quantity of organic matter in the surface soil.

On account of the small extent of erosional valleys in this county, alluvial types have not been developed except along the middle and lower courses of the streams. The material of these bottom lands consists of reworked silt and sand derived from the adjacent uplands. Owing to the presence of the gravelly substratum, the aeration and drainage are generally good; therefore, oxidation of the iron content has quite uniformly extended to a depth of several feet, and brown colors prevail in most of these soils. The rather low content of organic matter may be accounted for in the same manner as on the well-drained uplands. The débris from the heavy forest decayed upon the surface, forming a brown mold that soon disappeared after the ground was cleared; and only in semimarshy places did it accumulate uniformly in the form of black carbonaceous material, thoroughly incorporated with the mineral constituents. Toward the upper courses of the streams dark-colored soils of this character form a transition between the strictly alluvial types or brown sandy soils, correlated with the Genesee series, and the black silty soils, or Clyde silty clay loam.

The soils of the county have been classified in five series and three miscellaneous types. The actual and relative extent of each type is shown in the following table and their distribution on the accompanying map:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami silt loam	65,920	63.7	Genesee loam	1,024	0.4
Flat phase	96,192		Fox silt loam	640	.2
Clyde silty clay loam	56,704	22.3	Muck	384	.1
Carrington silt loam	24,256	9.5	Peat	64	.1
Genesee fine sandy loam	5,120	2.0			
Meadow	3,136	1.2	Total	254,720	
Miami loam	1,280	.5			

Miami Series.

The soils of the Miami series are brown, light brown, or grayish, and are underlain by heavier textured, yellowish and brown subsoils. Mottlings of brown and light gray are present in the subsoils in many places, particularly in the case of the clay loam member, which is by far the most extensive type mapped. The surface drainage is usually good, but artificial drainage is necessary in some of the heavier types. The soils are in the main derived, through weathering, from glacial till of a generally calcareous nature. Of this series two types, the silt loam and loam, together with a flat phase of the former, are mapped in Clinton County.

MIAMI SILT LOAM.

The soil of the Miami silt loam, to a depth of 6 or 8 inches, is a gray or very light brownish gray, friable silt loam. The upper part of the subsoil is a yellow or yellow and gray mottled silt loam that at a depth of 12 to 15 inches grades into a dull yellowish brown, slightly mottled, stiff, compact silty clay loam. Usually at a depth of 20 to 30 inches below the surface this mottled material merges into a yellowish-brown clay or clay loam, in which there is some coarse sand and a few pebbles. Below 36 inches the proportion of gravel and small stones is so large as to make the material difficult to penetrate. A few large bowlders are scattered over the surface of the type, but most of these have been removed from cultivated fields. Both soil and subsoil are decidedly deficient in organic matter.

The lightest colored portions of the Miami silt loam have a decidedly ashy appearance and a tendency to form a firm but rather porous crust after rains. This condition is largely the result of long cropping, with but few changes to clover and but scanty applications of manure. It is most noticeable on the flat phase of the type.

On the steeper slopes the soil has a decidedly brownish tint, is more or less sandy, and contains many small stones. At a slight depth the subsoil is a brown sandy or gravelly clay, quite compact, but seldom approaching a hardpan. The pronounced brown coloration of soil and subsoil in such locations is due to the more vigorous circulation of the soil moisture and air than takes place where the surface relief is milder and the subsoil contains less coarse material.

The Miami silt loam, with its flat phase, constitutes 63.7 per cent of the total area of the county. The only considerable area in which it is not extensively developed is Twelve-Mile Prairie, and even that large tract of black land contains many small spots of the light-colored silt loam.

The surface of most of this type is strongly undulating, and the natural drainage is good. Near the larger creeks the surface is more rolling than in the central parts of the interstream divides. As a rule, short, steep slopes face the narrow valleys and extend some distance back along the tributaries. There are also occasional low ridges a fraction of a mile long and mounds of a few acres extent that rise 10 to 20 feet above the surrounding land.

The Miami silt loam yields easily to tillage and on all the undulating to rolling portions has a physical structure quite favorable to the maintenance of good moisture conditions and to effective aeration. Where gravel beds occur at a depth of a few feet the moisture reserve is correspondingly reduced, but such conditions are usually found only on the apexes of sharp knolls and near the escarpments overlooking the creek bottoms.

As a rule, no free lime can be found within 3 or 4 feet of the surface, but at a slightly greater depth the material is very calcareous. The surface soil and the upper subsoil are acid, strongly so in all the lighter colored portions.

The average yield of corn on this soil may be placed below, rather than above, 40 bushels per acre. This estimate does not include the returns from low swales, where the soil approaches the Clyde silty clay loam, necessarily included in the mapping of the predominant type. A marked increase in yield invariably follows even moderate applications of manure or the plowing under of clover or bluegrass sod. Clover is especially beneficial, since its roots penetrate the compact subsoil and by their subsequent decay render it more open and permeable.

All this type responds to phosphatic fertilizers, but their most profitable use is with wheat. The yields of this grain are quite variable, ranging from 15 to 30 bushels per acre on most farms.

As a rule this type will not carry a heavy crop of oats to maturity if there is a marked shortage in the rainfall during May and June. The best crops are obtained when there is at least normal precipitation well up to the period of ripening.

If a stand of clover is obtained its subsequent growth is usually satisfactory, although not so heavy as on the Clyde soils. Considering the acidity of the surface soil, it is somewhat remarkable that clover does so well. No evidences of clover "sickness" are observable.

Bluegrass thrives on this type, notwithstanding the acidity of the surface soil and the fact that this is a lime-loving plant.

Farmers generally state that the quality of all grains and grasses grown on the Miami soils is better than that of the same crops on the more fertile black lands.

Apples, pears, and cherries do well on this type, and it affords favorable locations for orchards. The northerly slopes are preferred to southern exposures or to flat areas.

All this type was formerly covered with a heavy growth of hardwoods. Sugar maple, walnut, poplar, and several kinds of oak were the prevailing species on the more rolling portions, which still are locally termed "sugar-tree land." Where the relief is less pronounced white and post oak, hickory, beech, ash, and elm were more abundant, the last two being partial to those local depressions that had very poor drainage.

In general, the price of land of this type ranges from $125 to $150 an acre.

Miami silt loam, flat phase.—The flat phase of the Miami silt loam is distinguished from the remainder of the type by its smoother topography and lighter color. The relief is sufficient to insure good surface drainage, except in many level or nearly level spots. In general the underdrainage of this phase is somewhat inferior to that of the more rolling land. This is caused in part by the very silty character of the soil, but chiefly by the greater depth to which the compact silty clay loam subsoil extends. As a rule the brown gravelly bowlder clay is not found at less than 30 or 40 inches from the surface. During wet weather the subsoil soon becomes saturated and after rains cease it parts slowly with its excess water, causing the surface soil to remain soggy and cold where superficial appearances would indicate comparatively rapid drying.

In this phase there are many so-called clay spots where the soil is very light colored and often has an ashy, lifeless appearance when dry. Under tillage it becomes loose and pulverulent to a depth of several inches, but readily forms a rather firm crust after rains. The upper subsoil is a mottled gray and yellow silt loam with many dark iron stains, and usually many small, black concretions. The lower subsoil is a heavy, silty clay, usually of a bluish-gray tint, indicative of its imperfect aeration and frequent saturation. In some instances the subsoil throughout is a compact mixture of fine sand and silt, but with nearly as undesirable properties as the clay. Fortunately these spots are limited to a fraction of an acre, or a few acres at most, on the crests of local divides and in places at lower levels. Approaches to such undesirable physical structure, however, are quite common in places, especially where the land is not frequently sowed to clover or liberally manured.

Obviously the first requirement of such areas is better internal drainage. Tile drains must be laid only a few rods apart, as the lateral movement of water through such a dense clay is very slow. Wherever stumps have been removed by dynamite the physical con-

dition of the soil is greatly improved, as indicated by its more rapid drying after rains and the better growth of corn on such spots. This suggests the profitable employment of dynamite for loosening the subsoil of small patches where the dense bluish-clay substratum is found to be the cause of imperfect drainage.

The best farmers have found that the most practicable means of improving this phase is by the growing and plowing under of clover, deep preparation of the land for corn and wheat, and liberal applications of burnt lime or ground limestone. The phase is more in need of organic matter than the typical soil.

As a rule, no definite line can be drawn between the areas of the flat phase of the Miami silt loam and the more rolling lands. The separations on the soil map are approximately correct with respect to the larger areas, but many small developments are necessarily included in the larger tracts of the predominant soil.

MIAMI LOAM.

The soil of the Miami loam varies somewhat in composition, but usually consists of a heavy, slightly sticky loam containing considerable coarse sand and gravel. At a depth of 6 or 8 inches it grades into a compact clay loam, in which the proportion of sand and gravel may not be so high as in the surface soil. Below 20 to 30 inches the included pebbles and small stones are more abundant, and at some depth, usually less than 6 or 8 feet below the surface, a rather loose gravelly material is often found. Yellowish brown with a slight tinge of red is the prevailing color throughout the entire soil section, for the drainage and aeration are generally effective to a depth of several feet.

This type has been developed on slopes where erosion has removed much of the gray silt that occurs elsewhere on the uplands. In but few instances, however, is the silt entirely wanting. It forms an appreciable proportion of the surface soil on the steepest slopes, while on the milder inclines it constitutes so high a percentage of the material that the soil is a gray silty loam similar to the Miami silt loam. Definite boundaries between the two types can not be drawn, although the brown color, rougher topography, and more stony surface serve to distinguish in a general way the typical loam from the silt loam.

The blufflike slopes facing the creek valleys form a rough phase of this type. For the most part they are untillable, but afford good pasturage. Bluegrass thrives, and clover makes a better growth than on the lighter colored soils. This may be due to the slight depth at which limestone fragments are often found, indicating a calcareous subsoil. Only the widest portions of these areas admit of representation on the map. They are generally cultivated, and produce good corn and wheat.

The areas between Sedalia and Geetingsville are prominent ridges. The slopes in part are quite steep, but all of them are tillable. The surface is generally gravelly, and there are many small stones on all the sharpest inclines. As a rule, gravel beds form the substratum, but in most instances are at such depths as not seriously to interfere with the moisture conditions of the soil and subsoil. The drainage is very effective, however, and care is necessary to reduce the surface run-off to the lowest degree practicable. For cultivated crops this is best accomplished by deep plowing at right angles to the slope, so as to lessen the tendency to gullying, and on ground set to clover or bluegrass by avoiding close grazing and excessive trampling.

The average yields of corn and wheat on this type compare favorably with those on the Miami silt loam. Oats are more susceptible to the effect of dry seasons. This is also true with respect to clover and timothy on the mounds and ridges, but on some parts of the hillsides facing the valleys slightly seepy conditions prevail, and all grasses thrive. In such locations clover and alfalfa find the shallow depths to calcareous till especially favorable to their growth. Peach and cherry trees prefer well-drained soils, and this type is favorable to their best growth. In many instances old and thrifty apple trees are found on this type and on areas of the Miami silt loam resembling it.

Clyde Series.

The soils of the Clyde series are characterized by dark-brown to black surface soils and gray, drab, or mottled gray and yellowish subsoils. They are derived through deposition or the reworking of materials carried under glacial lakes or ponds, the dark color of the surface soils being due to the high percentage of organic matter caused by the decay of plants under swampy conditions. The soils of the Clyde series grade into Muck and Peat on the one hand and into such glacial-lake soils as the Dunkirk series on the other, without very sharp boundary lines. They are distinguished from the Poygan soils by the gray instead of reddish subsoils, and from the Fargo in the general absence of calcium carbonate. The topography is level and the soils are naturally poorly drained, but when reclaimed they are highly productive and valuable for corn, grass, sugar beets, cabbage, and onions. One type of the Clyde series, the silty clay loam, was mapped in this county. It is the second type in extent in the county.

Clyde silty clay loam.

The surface soil of the Clyde silty clay loam is a black crumbly silt or silty clay loam about 8 inches deep. The subsoil, to a depth of 18 inches or more, is a stiff, compact black clay or silty clay loam, which when dry breaks into rather coarse granules, but when wet is

inclined to be heavy and sticky. The lower subsoil is generally similar in texture to the middle section but much lighter colored. Dark drab or bluish gray, changing with increase of depth to light gray, is the usual coloration, but in many instances there is more or less pale-yellowish mottling. The lower subsoil usually lacks the jointed structure of the black material above, and therefore is more compact and often a smooth, tenacious clay or silty clay that offers much resistance to penetration by any implement and admits of rather slow water circulation.

The black color of the soil is due to the high content of organic matter. In marked depressions, especially if recently drained, this may be so abundant that the soil is loose and spongy, or even approaches a true Muck, but as a rule it is not present in greater quantities than sufficient to impart a very black color and crumbly structure to what would nevertheless be a silty clay loam, or possibly a heavy clay.

The organic matter consists of black carbonaceous material derived from vegetal remains decomposed in water, or under such conditions that air was partially excluded. Compared with the brown humus that forms in a well-drained soil from the decay of manure or organic remains of any kind, this old black humus is inert and contains in itself but little of the elements of fertility, but it gives a fine physical condition to the soil and renders it highly favorable to those organisms that develop nitrates.

Practically all of this type has poor natural drainage, and only since artificial drains have been so generally installed has the water table been permanently lowered. In comparatively few instances does the water table lie within 3 feet of the surface. Usually it is several feet below. Its former high average level occasioned the light color of the lower subsoil. The latter frequently contains so much calcium carbonate that it effervesces freely when hydrochloric acid is added.

The Clyde silty clay loam is found in the swales and basins that form such a characteristic feature of the upland topography. It also prevails throughout those broad, valleylike depressions in which the upper branches of the creeks formerly had tortuous and much obstructed channels. Phases of the type have also been developed in the flat portions of Twelve-Mile Prairie, and in other tracts that in their natural condition were semimarshy. In the vicinity of Hillisburg and Scircleville the Clyde soil is found on comparatively high ground, but the drainage was originally very poor.

The extensive distribution of the type and its close association with the local drainage is apparent at a glance at the map. Many small areas can not be shown, especially where the margins are a dark soil,

with only a little more organic matter than the surrounding type, or where the subsoil is a brown or yellow silty clay, indicating fairly effective underdrainage. The central part of even the smallest areas, however, is usually a typical Clyde soil.

In many instances small patches of "chaffy" soil are found in this type. These are simply places in which the organic matter constitutes a very high percentage of the surface soil. In a few places shallow muck occurs and the agricultural value of the land is somewhat uncertain. In all these extreme phases the upper subsoil is a very black clay or silty clay and as a rule quite compact, or often gummy.

Throughout most of the long, narrow areas drained by dredged ditches water-bearing gravel is found at 6 to 8 feet below the surface. Gravel also underlies portions of the type elsewhere, but as a rule is erratic in occurrence or too deep appreciably to affect the surface soil. All this gravel is more or less calcareous, and the whitish clay above it is usually limy. The substratum of the small areas is generally a yellowish bowlder clay.

The long, broken drainage lines shown on the map are mostly dredged ditches serving as outlets for thousands of rods of 6 to 10 inch tile drains. In wet seasons some of the type shows a lack of sufficient drains, but most of it is now farmed as conveniently as any of the uplands.

Corn is the most important crop grown on this soil, and yields of 80 to 90 bushels per acre are frequently obtained. The average yield is lower but probably is close to 60 bushels. In places where the soil has an excess of black vegetable matter and is somewhat mucky the leaves of the corn frequently turn yellow, the roots partially decay, and the whole plant fails to attain a normal height. This condition also sometimes occurs on ground not exceptionally high in organic matter. Heavy applications of stable manure will remedy the trouble for at least one or two years. Deep fall plowing to mix the clayey subsoil with the mucky surface soil is also beneficial. Muriate of potash at the rate of 100 to 200 pounds per acre will usually insure a good yield of corn on such ground, other conditions being favorable.

Wheat and oats do well on this type, except that in wet seasons the latter crop usually makes too much straw and is apt to lodge badly. Wheat is not usually fertilized. The yields range from 20 to 30 bushels per acre on most farms.

Clover does well on this type, and a stand is usually obtained with either wheat or oats, except under very unseasonable conditions. Alfalfa also thrives, and little difficulty is experienced in obtaining a good stand. Locations in which the depth to water-bearing gravel is only a few feet are preferred to those underlain by the bowlder clay. While the soil often shows some acidity if tested with litmus paper, it is less acid than the Miami soils.

Tomatoes usually make an earlier and more vigorous growth than on the lighter colored soils, but it is doubtful whether the quality is as good. Some canners prefer the tomatoes grown on the lighter soils, but growers naturally select the soils which produce the heaviest yields.

Late potatoes usually do well on this type, also cabbage, celery, beets, and other crops requiring a rather long growing season. Most of this soil is "earlier" than the lighter colored Miami types and therefore preferable in most instances for early garden crops. Strawberries, where flavor of the fruit rather than shipping qualities is desired, do best on a rich soil with abundant water supply. These conditions are fulfilled by this type, and it also seems possible that supplemental irrigation could be profitably practiced on limited acreages along the big ditches.

The present price of most of this type ranges from $150 to $200 an acre.

Carrington Series.

The types included in the Carrington series have dark-brown to black soils and light-brown to yellowish subsoils. They are derived almost exclusively from glacial-till material. Their topography is gently undulating to rolling, with occasional nearly flat areas. The soils in this series are found in the glaciated region from the Ohio River westward. In this series one type, the silt loam, was mapped in Clinton County.

Carrington silt loam.

The surface soil of the Carrington silt loam is a very dark gray to black silt loam 8 to 12 inches deep. The subsoil is a brown to yellowish-brown silty clay loam, more or less mottled with grayish streaks. The lower subsoil is similar to that of the Miami silt loam, usually a brown clay or clay loam containing considerable coarse sand and small gravel. This lower subsoil and the material beneath are the till or bowlder clay that forms the substratum of all the upland soils. It presents the usual variations in shades of yellow and brown, according to the degree of oxidation of iron content that has taken place and the relative proportions of clay, silt, and coarser materials.

The Carrington silt loam usually represents fairly well drained areas that were originally prairie or but sparsely covered with bushes and small timber. The organic matter in the soil has been derived chiefly from herbaceous vegetation. It is similar to the black carbonaceous vegetal remains which give the Clyde silty clay loam its distinctive color and loose structure, but the Carrington soil contains less of this organic material. It seldom forms such an appreciable proportion of the soil as to obscure the textural character of the mineral constituents.

The soil is invariably acid, according to litmus-paper tests, but not to such a marked degree as the Miami silt loam. At a depth of a few feet the substratum is usually calcareous.

The largest areas of Carrington silt loam are found in the southern part of the county, the type forming most of the Twelve-Mile Prairie. Nearly all the slightly elevated or undulating portions of this formerly treeless land consist of this type. The individual areas, however, occur in such intimate association with the somewhat lower lying Clyde silty clay loam that no very sharp boundaries between the types can be drawn. The areas in the western part of the county have more pronounced relief than those in the central part. Much of the type south and southeast of Frankfort has but slight elevation above the adjoining areas of Clyde soils, while between the lower course of Potato Creek and the Toledo, St. Louis & Western Railroad the Carrington silt loam is mostly high, well-drained upland.

For a mile or more to the north and south of Scircleville and Hillisburg and thence east to the county boundary there are many low, broad swells where the soil is a black silt loam practically identical with the Carrington type. In most instances the areas are less than 40 acres in extent and very irregular and rather indefinite with respect to boundaries. The highest points are usually the Miami silt loam, the slightly sloping land is Carrington silt loam, while all depressions and flats, however small, have a very black soil and other characteristics of the Clyde silty clay loam. Similar conditions prevail along the Chicago, Indianapolis & Louisville Railway from Cyclone toward Sugar Creek. Obviously no close distinction in soil types can be made in such localities, and the areas mapped as Clyde or Carrington represent the predominant character of black land in that particular area. Most of the areas of Miami soil embracing 10 acres or more are indicated.

The average yield of corn on the Carrington silt loam may be placed between 50 and 60 bushels per acre. Farmers usually give a higher estimate, but they include returns from the small depressions where the soil is the Clyde silty clay loam. The effect of the higher organic-matter content of the latter type and its greater moisture-holding capacity was very apparent in the dry season of 1914.

Wheat yields show a rather wide range, but usually do not fall below 18 or 20 bushels per acre. Commercial fertilizer is not commonly used on this type, but where applied there is an increase of yield. The effect, however, is not so marked as on the Miami silt loam.

Oats, clover, timothy, and minor crops do well on this soil. It also affords desirable land for small fruits and truck, being a

warmer and earlier soil than the Miami silt loam and having some advantage over the Clyde soils with respect to elevation.

The present price of desirably located land of the Carrington silt loam is about $200 an acre. Farms a little distance from towns or electric lines are held at prices ranging from $150 to $175 an acre.

Fox Series.

The types in the Fox series have gray and brown surface soils and brown subsoils. The series has typically a level topography, drained here and there by potholes or by valleys eroded since the deposition of the material as outwash plains or as terraces along streams within the glacial area or flowing out of it. The soils, therefore, consist largely or wholly of glacially derived material, but an essential characteristic is the presence of a large percentage of limestone. The Fox silt loam is the only member of this series mapped in Clinton County.

FOX SILT LOAM.

The soil of the Fox silt loam to a depth of 6 to 8 inches is a brownish-gray to light-brown silt loam. The subsoil to a depth of 12 to 18 inches is a yellowish-brown silt loam, grading below into a yellowish-brown compact silt loam to silty clay loam which gives way to beds of gravel at a depth of 2½ feet or more. The soil material is very much like that of the undulatory uplands. The type, however, has somewhat better underdrainage than the Miami soils, owing to the occurrence of gravel at a depth of 2½ to 4 feet below the surface. This possibly is not true of the portions of the larger areas farthest from the streams, for the soil in such places does not dry so soon after rains as that nearer the watercourse. Portions of the type are somewhat droughty, but the depth of soil and subsoil in general is sufficient to retain moisture throughout even dry seasons.

This type represents the high terraces or elevated bench lands found along the lower course of Wild Cat Creek. The surface of each of these small table-lands, only one or two of which embrace more than 100 acres, is level or nearly so except along the margin. The break to the valley is a steep declivity, while toward the uplands the surface rises so gradually that no well-defined boundary can be drawn between hillside and terrace. The elevation of the areas near the Tippecanoe-Clinton line is 30 to 50 feet above the bottom lands and that of the minor areas farther up the stream is 10 to 25 feet.

Wheat and clover do well on this type, and the returns from corn are somewhat better than the average on the Miami soils. The

soil is benefited by frequent rotations with clover, as the organic-matter supply is generally low.

In the following table are given the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Fox silt loam:

Mechanical analyses of Fox silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
2818041	Soil	0.5	1.9	2.4	7.2	5.6	69.8	12.8
2818051	Subsoil	.9	2.0	2.2	7.5	5.3	66.5	15.7
2818061	Lower subsoil	2.0	4.6	5.0	16.4	6.4	46.8	18.8

Genesee Series.

The Genesee series includes soils formed from dark-brown to grayish-brown alluvial sediments deposited along the major streams and their tributaries throughout the northeastern glaciated region, particularly where the Dunkirk, Volusia, Miami, and Ontario series constitute the principal upland soils. The soils of this series also occur for a short distance south of the glaciated area, where main streams have their headwaters in areas covered by these soil series. The sandy members of the series are prevailingly light brown to gray and the loam and silt loam members darker brown. The soils of this series are subject to either annual or frequent overflow. Two types in this series, the fine sandy loam and loam, were mapped in Clinton County.

Genesee fine sandy loam.

The surface soil of the Genesee fine sandy loam consists of a brown, friable fine sandy loam to silt loam, 10 to 20 inches deep. The subsoil has about the same texture as the soil, but is usually slightly lighter in color. In the narrow areas near the channels of streams the subsoil is usually a brown fine sandy loam, grading with depth into a sand. On the wider areas, particularly those having more elevation as the hills are approached, the soil is darker brown in color and contains a much greater proportion of fine material, while the subsoil is a heavy fine sandy loam to silt loam in which the coloration ranges through various shades of brown, indicating good underdrainage, but a slower movement of the soil water than takes place in the lower sandy areas of more recent deposition.

With the exception of the uneven sandy deposits along the channels, where the texture may vary to coarse sandy loam, all of this type is in cultivation. Wheat makes good yields, although its culture is confined to the areas above usual winter overflow. Notwithstanding the small content of organic matter, the average

yields of corn on this type are generally higher than on the Miami silt loam. The good aeration to a depth of several feet and the presence of water at no great depth are undoubtedly favorable factors, while the occasional overflows of the lower areas and wash from the adjoining slopes onto the higher areas contribute much fertility.

Clover does well on these low lands and many small fields of alfalfa have been established. Many favorable locations for the latter crop may be found in all of these valleys. The best locations are those where flood water does not stand for any length of time, and where a comparatively fine-textured subsoil extends to or within a few feet of the water-bearing gravel. This practically assures an ample water supply, the first requirement for a heavy growth of vegetation. Liming is necessary for best results, as this soil is somewhat acid.

GENESEE LOAM.

The type mapped as Genesee loam occurs chiefly along Wild Cat Creek. The heavier portions have somewhat the appearance of the Clyde silty clay loam, but contain more sand and the subsoil is usually darker colored and has better natural drainage. Near the stream channels and on the lower lying portions in general the texture is coarser, the type being often a loam or fine sandy loam of a dark brownish gray to dark-brown color and underlain at a depth of 12 to 15 inches by a brown and gray mottled loam. In such places the natural drainage is better than in the wider parts of these valleys. The flatter land has been tiled or ditched, however, so that all this type except along the channels is cultivated, its agricultural value being nearly the same as that of the Clyde soils.

Along the lower courses of the streams there are occasional areas at the foot of the bluffs where the drainage was formerly so poor that much black humus accumulated in the soil. In several places shallow Muck beds had formed and there yet remains an excessive quantity of organic matter in the soil. Such areas are restricted to a few acres in most instances. All of these areas have been drained and the soil is excellent for corn and grass. Only the larger ones are indicated on the map as Genesee loam.

Miscellaneous Material.

MEADOW.

Along the small branches the bottom lands are usually of such variable character that a textural classification is impracticable. This land is mapped as Meadow. The soil ranges in texture from a brown coarse sandy loam to black silty loam, while the uneven surface causes varying conditions with respect to drainage. Nearly all of it is subject to frequent overflows, and therefore only the higher ground is suitable for cultivation. Most of these narrow valleys are

used for pasturage. Bluegrass thrives, making a heavier growth and remaining green longer than on the uplands.

The Meadow of the larger streams is usually a sandy deposit from recent floods, or low strips of ground immediately bordering the banks. Except for the timber and some pasturage afforded, these small areas are of little economic importance.

MUCK.

The largest body of Muck is found on Swamp Creek at the east boundary of the county. It is over a mile long and averages less than one-fourth mile wide. To a depth of 12 to 18 inches the material consists chiefly of very black, finely divided vegetal remains. More or less earthy material is present, especially along the margins of the tract and in the lower part of the deeper accumulations in the central portions. In most places a black, sticky clay 20 to 30 inches in depth forms the subsoil, below which there is a more compact, light-colored clay. At a depth of a few feet below the Muck water-bearing sand and gravel are found.

Smaller areas of Muck occur on Potato Creek north of Colfax, also on Spring Branch north of Jefferson. In most of these beds the Muck proper is less than 20 inches deep, underlain by clay, which in turn usually overlies gravel.

Occasional shallow accumulations of Muck are found on the uplands, while somewhat mucky soil, or "chaffy" land, is quite frequently encountered in the larger areas of Clyde silty clay loam. In such instances the excessive quantity of black, carbonaceous material mixed with the mineral constituents of the soil imparts the loose, "chaffy" character to the land.

Practically all the Muck accumulations enumerated above are now cultivated. Corn makes a good yield, but the quality is not equal to that produced on ordinary soils. Liberal applications of stable manure or the use of some form of potash salts is necessary to insure a stand and prevent the rotting of the roots and yellowing of the plants that often occur on such land. One hundred to two hundred pounds of muriate of potash or sulphate of potash usually proves effective. Deep fall plowing, in order to incorporate the clayey subsoil with the organic material, is also beneficial.

Timothy and bluegrass thrive so well on such land that its use for hay and pasturage is profitable. Onions, celery, and cabbage do well.

PEAT.

In the northwest corner of the county there are several small Peat beds. The largest, found in section 31, Ross Township, embraces about 20 acres. The material to a depth of about 3 feet is a mass of coarse, brown, fibrous vegetal remains. The surface resembles

rotten straw, while at a depth of a foot or so the material is not unlike decaying sawdust. A very light colored calcareous clay forms the substratum. In the dry season of 1914 this Peat dried to a depth of 2 or 3 feet, and cracks several inches to a foot wide intersected the surface in numerous places. A very rank growth of smartweed and pokeberry covered most portions not occupied by alders. The other, smaller areas are in part Muck, but the material is not sufficiently decomposed to form a safe soil for cultivated crops.

Timothy would probably be the most successful crop for such areas as are sufficiently firm to admit of seeding to grass.

SUMMARY.

Clinton County is located in the north-central part of Indiana, and has an area of 398 square miles, or 254,720 acres. Most of the surface is undulating to moderately rolling, with very little land unsuitable for tillage. All the county was formerly timbered except a tract in the southern part known as Twelve-Mile Prairie.

Corn, wheat, oats, and clover are the principal crops. Many hogs are raised, but cattle feeding and dairying are not as extensively practiced as is desirable for the maintenance of soil productiveness. Much grain is sold from the farms.

The soils are derived from a comparatively shallow surface layer of silty material, usually less than 3 feet deep, overlying bowlder clay of great depth.

The Miami silt loam is the most extensive type. The natural drainage is generally good. The soil is well adapted to general farm crops, although it has not a high degree of productiveness.

The Clyde silty clay loam represents the black soils of the formerly ill-drained depressions. All of this type is now reclaimed and produces good crops of corn, clover, and wheat.

The Carrington silt loam is found in somewhat higher situations than the Clyde soils, but is associated with them. It was formerly prairie and has a much blacker humus in the surface soil than the Clyde soils. It is a very desirable soil for grain, especially corn.

The Genesee fine sandy loam is the fourth type in extent and is a good soil for general crops.

The creek bottoms are mostly not subject to damaging overflows and regularly produce good crops of corn, wheat, and grasses.

The recent alluvial deposits on the immediate banks of the creeks are generally untillable. These, as well as the narrow valleys of the small branches, are indicated on the soil map as Meadow. A number of small areas of Muck occur in the stream valleys, and occasional small beds are found in the black soils of the uplands.

The present price of land in Clinton County ranges from $125 to $200 an acre.

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[PUBLIC RESOLUTION—No. 9.]

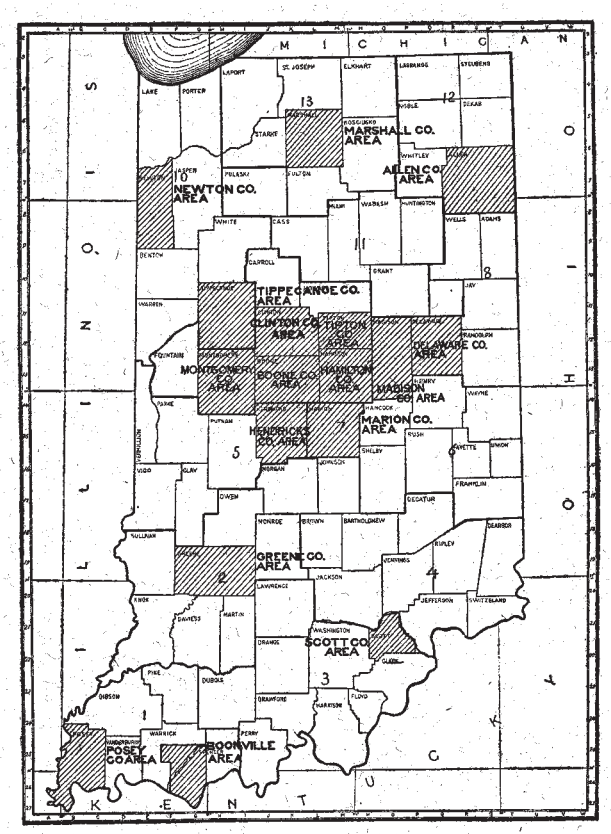
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Indiana.

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U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
INDIANA
CLINTON COUNTY SHEET

STATE OF INDIANA
DEPARTMENT OF GEOLOGY
EDWARD BARRETT, STATE GEOLOGIST

SOIL PROFILE
(3 feet deep)

Miami loam — L, Cl

Miami silt loam — Sil, Sicl, Cl

Flat phase — Sil, Sicl, Cl

Fox silt loam — Sil, Sicl, Gr

Carrington silt loam — Sil, Sicl, Cl

Clyde silty clay loam — Hsil to Sicl, Hsicl, Sic

Genesee fine sandy loam — Fsl, Fsl

Genesee loam — L, L

LEGEND

L —Loam
Cl —Clay loam
Sil —Silt loam
Sicl —Silty clay loam
Gr —Gravel
Hsil —Heavy silt loam
Sic —Silty clay
Fsl —Fine sandy loam
Hsicl—Heavy silty clay loam

LEGEND

Miami loam — Mi
Miami silt loam — Ms
Flat phase — Ms
Fox silt loam — Fl
Carrington silt loam — Cl
Clyde silty clay loam — Cs
Genesee fine sandy loam — Gr
Genesee loam — Gl
Meadow — M
Peat — P
Muck — Mu

R. 2 W. | R. 1 W. | R. 1 E. | R. 2 E.

T. 23 N. | T. 22 N. | T. 21 N. | T. 20 N.

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Scale 1 inch = 1 mile
1 ½ 0 1 2 3 4 Miles

W. E. Mc Lendon, Inspector Northern Division
Soils surveyed by W. E. Tharp, of the U. S. Department of Agriculture and R. H. Peacock and C. M. Rose of the Indiana Department of Geology

A. Hoen & Co. Lith. Baltimore, Md.

Field Operations
Bureau of Soils
1914